PERCEPTUAL ACCURACY AS A FUNCTION OF STIMULUS VALUE

By

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A DISSERTATION PRESENTED TO THE GRADUATE COUNCIL OF
THE UNIVERSITY OF FLORIDA
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA
December, 1964

ACKNOWLEDGEMENTS

The author wishes to thank the members of his supervisory committee: Drs. Albert M. Barrett, Elmer D. Hinckley, H. T. Martin, Jr., and Marvin E. Shaw, for advice and helpful criticism in the planning and presentation of this study. In particular he wishes to thank the chairman of that committee, Dr. H. D. Kimmel for his effective guidance and consistent encouragement since the inception of this work. Thanks are due also to Mr. Horace Y. Gillett for his help in processing data and to Dr. Ann M. Borresen for her able assistance throughout this study.

While it is not possible here to thank all of the persons who have contributed, in a number of ways, to the author's academic progress, two require special mention. The example, interest, and encouragement provided by Dr. Carl E. Smith and the late Dr. Henry Wunderlich were of crucial importance in the academic and personal progress which made this study possible.

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CHAPTER I

INTRODUCTION

Background of the Problem

There has been a considerable amount of research on the effects of motivational variables on perception. One major trend in this research stems from what Bruner (1958) refers to as the "New Look" in perception. Bruner discusses a series of studies on the "behavioral" determinants of perceptual organization. "Behavioral," in this context, relates to such influences as needs, attitudes, experience, and social values. These determinants are placed in contrast to "autochthonous" influences which refer to formal stimulus factors (e.g., physical intensity, receptor adaptation).

Allport (1955) also has presented a comprehensive review of the important theoretical approaches to perception. He refers to the "New Look" as the work of the directive-state theorists. He cites six hypotheses which are central to the directive-state approach. While all of these hypotheses relate to the effects of motivational determinants on perception, the following is of principal concern in the present study: "The value of objects to the individual tends to determine their perceived magnitudes"

(Allport, 1955, p. 312). This hypothesis has been stated in a number of different ways by various investigators, but none of the specific hypotheses appears to differ significantly from Allport's general statement.

Apparently, psychological research with important theoretical implications or significant empirical findings can always be shown to have related antecedents. McCurdy (1956) points out that there was a study as early as 1902 by Messenger on the apparent weight of various denominations of money. He found, among other things, that university students and faculty members considered one dollar bills to be lighter than those of a higher denomination. MacDougall (1906) did a follow-up study using grade-school girls. MacDougall indicated that his results favored the view that monetary value has a positive effect on estimates of physical quantity.

A study by Bruner and Goodman (1947) was one of the first self-conscious, systematic approaches to the specific notion that value accentuates apparent size. This research was important because it was the beginning of a series of experiments on the effects of motivational determinants on this aspect of perception. This study will be examined in some detail because it also tended to determine the methodology used in a number of later studies.

Bruner and Goodman were investigating the following three hypotheses:

1. "The greater the social value of an object, the more would it be susceptible to organization by behavioral determinants. It will be selected perceptually from among alternative perceptual objects, will become fixated as a perceptual response tendency, and will become perceptually accentuated.

2. "The greater the individual need for a socially valued object, the more marked will be the operation of behavioral determinants.

3. "Perceptual equivocality will facilitate the operation of behavioral determinants only insofar as equivocality reduces the operation of autochthonous determinants without reducing the effectiveness of behavioral determinants" (Bruner and Goodman, 1947, p. 36).

Bruner and Goodman (1947) investigated only the perceptual accentuation aspect of the first hypothesis. Accentuation, as used in the literature in this area, turns out to be a rather broad term having as its nearest synonym the word "vividness." "Vividness," in this context, includes at least the notions of increased clarity, increased brightness, or increased apparent size. Bruner and Goodman, apparently, were referring solely to the size aspects. Equivocality, in general, refers to the decreased effectiveness of formal stimulus properties, hence allowing for the increased operation of motivational ones. If the stimuli are clear and the distinctions sharp, the effect of motivational variables is reduced and may even be absent. The whole issue of equivocality will be ignored below because, in the relevant research, the equivocal conditions were those in which the subject (S) worked from memory. This issue is different from the one that concerns us.

The subjects (Ss) used in the Bruner and Goodman study were 30 ten-year-old children of apparently normal intelligence. The apparatus consisted of a rectangular wooden box at one end of which was a five-inch square, ground-glass screen with a knob at its lower right hand corner. At the center of the ground-glass screen was an almost circular patch of light cast upon the back of the screen by a 60 w. incandescent light shining through an iris diaphragm which could be varied in diameter from 1/8 inch to two inches by turning the knob on the front of the box. Bruner and Goodman state, "The circle was not truly round, containing the familiar nine elliptoid sides found in the Bausch and Lomb iris diaphragm. It was so close to round, however, that the Ss had no difficulty making the subjective equations required of them" (1947, p. 37). The psychophysical method of average error was used. The two experimental groups (n = 10 in each) were asked individually to estimate the sizes of coins (from a penny to a half dollar) from memory. The Ss did this by adjusting the circle of light to correspond to the remembered size of the coin, first in ascending order of value, then in descending order. Two judgments were made for each coin in each order, one from the open and the other from the closed position of the diaphragm. A total of four judgments was made by each child for each coin.

Following the memory series, a similar series was run, utilizing the same order of presentation, with the coins present. The coins, individually, were held close to the center of the palm of the left hand at a level with the light circle and six inches to its left.

A control group of ten Ss followed an identical procedure but with medium gray cardboard discs of sizes equivalent to the coins. The coins were judged larger in size than were the gray discs. Also, the greater the value of the coin, the greater was the deviation of apparent size from the actual size. The exception to this was the quarter which was seen as larger than any of the other coins. Bruner and Goodman (1947) refer to an unpublished study by Bruner and Postman, using adult Ss, in which this exception did not occur.

The second hypothesis was also supported. The ten experimental Ss from well-to-do socio-economic backgrounds overestimated all of the coins but not to the same extent as the ten experimental Ss from poor socio-economic backgrounds.

Carter and Schooler (1949) tested the same hypotheses using larger groups and similar stimulus conditions. Their 48 *S*s served as their own controls making estimates of aluminum discs as well as light gray cardboard discs and coins. Carter and Schooler also used the method of average error and an apparatus similar to that of Bruner and Goodman (1947). Their spot of light was an actual circle rather than a close approximation.

They found no significant difference between their "rich" and "poor" *S*s in their judgments of any of the three sets of stimuli. When the data for the two groups were combined, there was a tendency for underestimation of small coins and discs. *S*s tended to overestimate when a 25-cent and a 50-cent coin were the standards. While all of the stimuli of this size were overestimated, the coins were seen as significantly larger than the cardboard discs. The estimates of the aluminum discs fell in between these two with only the difference between the 50-cent sizes being significant. They concluded that their study did not support the findings of Bruner and Goodman (1947) and that the perceived size is closely related to its real size where judgments are being made regarding the actually present objects.

Lambert, Solomon, and Watson (1949) attempted to investigate the specific hypothesis that, "'value,' as defined by changes in apparent size, is a function of both reinforcement and extinction procedures" (p. 637), thus avoiding some of the difficulties inherent in the unknown factors involved in the rich-poor dichotomy. Using 54 Ss, three to five years old, they attempted to control the value continuum by utilizing a previously neutral object. Their experimental Ss worked to obtain tokens (poker chips) which could be put into a slot in a machine which automatically delivered a piece of candy. For the control Ss, the candy came directly from the work of turning the crank on a machine without the mediation of the token. Size estimates were obtained prior to the experiment, after ten days of reward, after extinction had occurred (eleventh day), and after reward had been reinstated (twelfth day). Measurements were taken with the equipment used by Bruner and Goodman (1947). The only other variation in method was that the token was pasted on a five-inch square gray cardboard and was held by the experimenter so that it was parallel to the spot of light. In general, both groups overestimated the size of the token in all four test conditions. There was a significantly greater overestimation by the rewarded group after ten days, although, for some unknown reason, the control group also showed a trend in that direction. After reinstatement of reward, the experimental group saw the tokens significantly larger than they did on the extinction day. They did not see the token as significantly larger than did the control group, however.

Ashley, Harper, and Runyon (1951) in a coin study attempted to match everything but the perceiver's psychological organization. They did this by using all Ss (17 college students) in all experimental conditions. The rich-poor continuum was varied through the use of suggestion under hypnosis. In one portion of the experiment, the value of a slug was also varied from lead to platinum by suggestion. Again, the method of average error was utilized with two adjustments for each comparison and with an apparatus similar to that of Bruner and Goodman (1947).

The "poor" *S*s consistently overestimated the size of the coin. The "rich" *S*s consistently underestimated the size of the coins. As the suggested value of the slug increased, the size estimates also increased. Again, the poor *S*s overestimated substantially more than the rich *S*s did.

Bruner and Rodriques (1953) attempted to explore some of the factors which might have produced the divergent findings between the Bruner and Goodman (1947) study and the later one by Carter and Schooler (1949). They did this by replicating parts of the design of each experiment, with some additional modifications of their own. For example, they used a variable six-chorded light figure, a nine-chorded light and a circular light for their *S*s to adjust. They obtained mixed results but did find that metal discs were generally seen as larger than paper ones and that coins were generally seen as larger than metal discs. They also found that the nine-chorded variable light, the one used by Bruner and Goodman, yielded the largest amount of overestimation of the coins and the least overestimation of discs. They stated that this trend fell short of statistical reliability and that no explanation was apparent.

They also found that the relative value of an array of objects does have an accentuative effect on their apparent size but that this effect appears to be in terms of relative apparent size rather than in absolute apparent size of the objects in the array. For example, the overestimation of a quarter in relation to the overestimation of a penny is significantly greater than the overestimation of a quarter-sized disc in relation to the overestimation of a penny-sized disc. All stimuli, with the exception of the penny, were overestimated to some extent in all of the experimental conditions. The penny sizes were sometimes underestimated but this underestimation was greatest with the paper discs.

Lambert and Lambert (1953) extended the work of Lambert, Solomon, and Watson (1949) in two further studies utilizing poker chips as tokens. Once again, the apparatus used was the same as that in the first Bruner and Goodman (1947) study. The Ss used were three-to five-year-old children. In experiment I of this study, the S worked to receive a red token, inserted this token in a slot, turned the crank another nine turns, and received a white token. The white token was then inserted in the machine and a candy gum-drop was automatically ejected. A day's trials ended when S received a blue token and was informed that his turn was over for that day. While all three tokens were overestimated before, during, and after the reinforcement sequence, no trends were evident as a result of the reinforcement period.

Because it was felt that the use of the blue token might have, in some way, neutralized the expected effect, a second experiment was done. In this experiment, the reinforcement program was two days long and the blue token was omitted. The results were unclear. There was a significant increase in the measured overestimation of the white token after five reinforcements. Shifts in the estimate of the red token were not significant, but it was seen as largest after the extinction trial.

Tajfel and Cawasjee (1959) did an interesting study generated by Tajfel's (1957) theoretical paper which will be discussed below. They used British coins of two shillings and two shilling and six pence, "differing, for all practical purposes, in size only." The control stimuli were coins presumably having no value to the Ss. Two hundred Ss each made one judgment of an experimental or control stimulus presented successively. The experimenter (E) held the coin flat in the palm of his hand about 16 inches from the S's eyes and asked him to estimate the diameter in 0.1 inch units. The Ss were recruited at restaurants, libraries, parties, on trains, etc. The hypotheses were that, in the valued condition, the differences between the perceived sizes of the large and small stimuli would be accentuated and, secondarily, that the valued coins would be seen as larger than the control coins. The accentuation of judged differences between the stimuli in the value group was reported to be significant. Overestimation as a function of value was not supported statistically, although a moderate trend was obtained with the larger coin. Another way of looking at the obtained accentuation effect is that there was a significant overestimation of the larger coin in relation to the larger control stimulus.

Rosenthal (1951) attempted to assess the differences in the overestimation phenomena for valued objects in children of different ages. He used the method of average error and an apparatus similar to that of Bruner and Goodman (1947). He obtained interesting results which, unfortunately, did nothing to clarify the already confusing findings in this area. He found, for example, that a coin presented in the S's hand was estimated as larger than a coin viewed on glass. However, an aluminum disc on glass was estimated as larger than a coin on glass. Poor six-year-olds estimated coin sizes as significantly greater than did rich six-year-olds. Rich ten-year-olds estimated the sizes significantly larger than did poor ten-year-olds.

Dorfman and Zajonc (1963) attempted to place the value-accentuation problem in a different theoretical context. Citing a number of studies in which extraneous stimulation has produced accentuation effects in judgments of brightness, pressure, etc., they wondered whether drive stimuli and external stimuli might not function in a similar way. If this were true, the motivational findings in the coin studies might be viewed as special cases of sensory interaction. External stimuli should, then, have the same accentuation effect upon estimation of coin size as, for instance, low economic status has. Utilizing the method of average error and a matching apparatus similar to the type employed by Bruner and Goodman (1947), they investigated the effects of socio-economic status, extraneous sound, and the color of the background against which the coin stimuli were presented. In general, the stimuli were overestimated although these overestimates were apparently not significant. There was no significant effect from sound or from sound by background interaction. No differential effect was obtained for the rich-poor dichotomy. Both coins and discs were estimated as larger when exposed on a black background. This indicates a significant source of variation within studies and from study to study that has not previously been controlled.

While the present study was largely concerned with the results of the research most clearly related to the coin-size issue, it is interesting to note that other investigations of the effect of value on accentuation of perception have yielded similarly inconsistent results. Beams

(1954), for instance, found an overestimation of size of favored food objects by children. Botha (1959), utilizing colored pictures of liked and disliked school books and foods, obtained mixed results. Klein, Schlesinger, and Meister (1951) utilized positively or negatively valued symbols inscribed on discs. They felt that their results gave equivocal support to the value-accentuation hypothesis. Solley and Lee (1955), in a similar study with dollar signs and swasticas inscribed on discs, supported the value-accentuation hypothesis.

Because the straightforward value-accentuation hypothesis has failed to find consistent support in a variety of empirical tests, an attempt has been made to make sense of the varied findings by organizing them around different explanatory concepts. McCurdy (1956) discusses the concept of _schema_ as a possible explanation for some of the findings. _Schema_, in this context, refers to some disposition not in itself directly experienced but manifesting itself in imagining, remembering, perceiving and acting. The schema is organically built up out of past experiences and reactions and it functions as a stabilizing factor in new contacts with the environment. McCurdy suggests that the schema for coins is less concerned with the size of the coins than it is with the ordering of the sizes in the array. As most of the studies previously discussed do show the correct ordering of the sizes even though some or all of the estimates may be accentuated, the notion of schema does seem to fit this aspect of the findings. It does not account for value-accentuation in general and, if it is stretched to fit, it cannot account for the exceptions. McCurdy conjectured that departures from accurate size estimation in value or reinforcement situations might better be interpreted as the result of the interference of expansive emotional states with the meticulous adjustments required.

Tajfel (1957) believes that the findings can be ordered around the hypothesis that the Ss actually accentuate the differences in the array of valued stimuli. He excludes a number of studies as not being relevant. These are the studies in which changes in value are related in no apparent way to changes in the physical dimension which the Ss are required to judge. In the experiment by Lambert, Solomon, and Watson (1949), for example, the color of the discs was the determinant of its value, but S was estimating its size. Tajfel (1957) agrees with McCurdy (1956) that S exaggerates the differences between the various coins and that this is a "good error." Tajfel feels, however, that the concept of schemata is not always applicable as an explanatory device for this finding. He concludes that the use of "accentuation of differences," as an explanatory concept, accounts better for some seemingly contradictory results.

The two theoretical formulations above have the advantage of taking a look at some of the previously collected data from a different point of view. To a certain extent, both McCurdy (1956) and Tajfel (1957) have looked at, and are hypothesizing about, a different aspect of the empirical findings than did the original investigators, Bruner and Goodman (1947). While it is not important here to evaluate the adequacy of these theoretical formulations, several comments are appropriate. First, these formulations do not comfortably encompass the results of all of the studies we have discussed. Second, they do not encompass all of the findings of the studies with which they are explicitly concerned. The different estimates of coins, aluminum discs, and cardboard discs or coin-in-hand and coin-on-paper are examples of the latter. Third, a review of the studies in this area suggests the possibility that their results can be accounted for without either the theories that generated them or the ones later invoked to account for them. It may be that the findings are a function of the methods used or of real physical stimulus differences. Coins, metal discs, and paper discs may differ in value, but they also differ markedly in other stimulus properties. While nearly all of the studies cited above have used the method of adjustment or average error, many of them have used only two adjustments for each size estimation. None has used more than four. This is less than is usual for experiments in psychophysics. The method of average error is also the one least similar to the natural situation in which size is responded to and the only one requiring active movement of the S. It can surely be said that results in psychophysics are, to some extent, a function of the method used (Guilford, 1954).

The results of the studies mentioned above have been mixed, inconclusive, and, frequently, contradictory. In what are essentially psychophysical experiments in size perception, there are apparently a number of shortcomings in or, at least, questions about the methods and controls utilized. The need for further research, with improved methodology, still exists.

Brown (1961) has reviewed the literature on the effect of value on perception and made the following statement: "When judgments are made of the size of physically present coins, under controlled conditions, their value is an as yet unproved determinant of their apparent size" (p. 294). He then suggested a different orientation of the problem. Utilizing the framework of multiplicative-drive theory, he predicted what would be expected to happen in a well-designed and controlled study. According to Brown, the value of the coin, through anticipatory goal responses and concomitant incentive motivation, should yield an increment in generalized drive. When "larger than" and "smaller than" judgmental response strengths (habit strengths) are not equal, an increase in drive would magnify the absolute differences between their excitatory potentials and would increase the frequency with which the dominant reaction is evoked. Intensified drive, then, would be expected to increase the steepness of the slope of the psychophysical function through the mid-range but would not displace its central tendency. That is, the point of subjective equality (PSE) should not shift, but the difference threshold (DL) should decrease _in the value condition_. The present investigation, approaching the problem from Brown's frame of reference, tested the following hypotheses while, at the same time, trying to control for some of the other possible sources of confusion found in previous studies:

Hypothesis I: The average PSE for coins will be the same as that for discs of the same diameter.

Hypothesis II: The average DL for coins will be smaller than that for the same size discs and this difference will be greater for coins of greater value.

Hypothesis III: The average DL for 25-cent-size discs will be smaller than for the 50-cent-size discs. A similar prediction is made for the DLs for the 25-cent and 50-cent coins. This prediction is a simple test of Weber's Law in this situation.

Hypothesis IV: PSEs and DLs will be the same for male and female Ss in all conditions. Although no experimenter in this area since MacDougall (1906) has mentioned the sex of his Ss, it was felt that this variable warranted investigation, if only for control purposes.

CHAPTER II

METHOD

The method used in the present study was substantially different from that used in the studies surveyed in Chapter I. The present approach attempts to overcome some of the shortcomings in the design of previous experiments and was developed during a series of pilot studies with 24 *Ss*.

Subjects

Sixty young adults with normal or corrected-to-normal vision were used. All of the *Ss* were less than 30 years of age. Most of them were college students in their early twenties. The *Ss* were volunteers for this experiment, although about half of them came from introductory psychology classes and were given some course credit for participating in research.

Forty-eight of the *Ss* were used in the main experiment. The other 12 were run in a control experiment in order to have additional comparison data. Each of these groups was made up of an equal number of male and female *Ss*.

Data from five *Ss* were discarded. The first four *Ss* run could not be used because equipment failure made it impossible to analyze their responses. One S was replaced when it was discovered that she exceeded the age limit.

Apparatus

The four standard stimuli (S_s) used were a 25-cent coin, a 25-cent-size disc, a 50-cent coin, and a 50-cent-size disc. Sixteen comparison or variable stimuli (S_v) were used. The S_v were in two sets of eight, each set appropriate to a given S_s. The S_v were stainless steel discs, four of which were smaller than the S_s with which they were compared and four of which were larger. The S_v varied in 0.3 mm. diameter increments. For each set, then, there was an S_v which was as little as 0.3 mm. larger than the S_s against which it was compared and one as much as 1.2 mm. larger. This relationship was also true for the S_v which were smaller than the S_s against which they were compared. The S_v had a raised rim, similar to that of a coin, but without the knurled or fluted edge. The surface of each disc was flat but with cross-hatching scribed into the surface. The 25-cent coin and the 50-cent coin used as S_s were uncirculated coins. The 25-cent-size disc and the 50-cent-size disc S_s were made from uncirculated coins of the same year and mintage as the coin S_s. These discs had the faces ground off on one side leaving only the rim with its fluted edge identical to that of the coins. A grid similar to that on the S_v was inscribed into the face of both of these discs.

Ferrous washers were glued onto the back of each of the stimuli used.

A white board, 15 inches square, was used as the background against which the stimuli were viewed. This background was mounted in a vertical position on a swivel base. Magnets were imbedded in one surface of the board so that the washer-backed discs and coins could be placed against the board and held there magnetically for S to view. This apparatus was placed on a table along with the rest of the experimental equipment. A white cardboard shield was attached to the table directly in front of and below the background, blocking the S's view of the swivel base, the stimuli that were not actually being presented, and the movements of the experimenter.

Because of the tendency of the coins and coin-metal discs to tarnish noticeably with one day's handling, the stimuli were cleaned daily. The background also discolored with use and was washed daily and repainted each week.

The Ss' responses were recorded automatically by solenoid operated signal markers worked by S. The S held a small metal response box in his lap or hands. This box had two buttons, one on the left side (marked "left") and one on the right (marked "right"). The buttons were electrically connected to the signal markers so that depressing a button actuated the corresponding pen, which marked S's responses on the moving record paper. The signal marker conveyed no information back to S other than the click of a pen being actuated. This signalled to both the experimenter and S that a response had been made and recorded.

Procedure

The method of constant stimulus differences (Guilford, 1954) was used. There were four experimental conditions. Each S served in all conditions. In condition LV, the 50-cent coin was the S_s. In condition LN, the 50-cent-size disc was the S_s. In condition SV, the 25-cent coin was the S_s. In condition SN, the 25-cent-size disc was the S_s. The larger set of S_v were used in conditions LV and LN and the smaller set for conditions SV and SN.

Table 1 presents a diagram of the four experimental conditions. The order of administration of the conditions was counter-balanced among the Ss in each group.

The S was seated facing the vertical background against which the stimuli were placed. In this position the stimuli were presented directly in front of S and approximately nine feet away. For most Ss, the stimuli were a few inches above eye level. The E stood behind the background.

The following instructions were read to each S:

Table 1

Plan of Main Experiment

	V(alued)		N(eutral)
L(arge)	S_s - 50¢ coin	$\underline{S_s\ 30.5}$[a]	S_s - 50¢-size disc
S_v -	29.3 29.6 29.9 30.2		30.8 31.1 31.4 31.7
S(mall)	S_s - 25¢ coin	$\underline{S_s\ 24.1}$	S_s - 25¢-size disc
S_v -	22.9 23.2 23.5 23.8		24.4 24.7 25.0 25.3

[a] All PSEs reported in mm.

> You will be shown a series of circular objects. They will be presented against this background in pairs, side by side. Each time the paired objects are presented you are to indicate which is larger. If the object on the right is larger, push the button on the right-hand side of the box you are holding. If the object on the left is larger, push the button on the left-hand side of the box. For each pair of objects you will be letting me know which one is larger by pushing the button on the same side as the larger object.
>
> Sometimes you may find it difficult to tell which of the two objects is larger. They will never be exactly the same size, however, so please make a judgment even though it may be difficult. We will not be able to talk once the experiment has begun. Do you have any questions?

Questions were rare. When S did have questions, they were answered by re-reading the appropriate part of the instructions. If S's questions related to the goals of the study, etc., he was reminded that a resume of the experimental findings would be available as soon as the results had been analyzed. All Ss had previously been informed of this on the experimental sign-up sheet. When it was evident that the instructions were clear and that there were no further questions, E walked over to S and showed him, at close range, the standard and a variable to be used in that session. The showing of the stimuli was accompanied by the statement, "These are the kinds of objects you will be looking at this time." After this, the actual experimental presentations began. The E placed two stimuli (S_s and one of the S_v) against the background, turned the background so that it faced S, and waited for S's response. After S responded, E turned the background, removed the stimuli, and placed the next pair of stimuli on the board for S to judge.

A restricted random order of presentation of stimuli was established for balancing the left-right locations of the S_v. All S_v appeared equally often on the right and left sides. The S_s appeared an equal number of times on each side and was larger half of the time in each position. Each S was given 160 trials, 20 comparisons of the S_s with each of the S_v. This constituted a complete session in one experimental condition. In general, the Ss returned at the same time on the next three days to be run in the three remaining experimental conditions. Because of scheduling problems, it was necessary to make some exceptions to this general rule but no S was run more than once in any 24-hour period and no more than one day elapsed between experimental sessions.

With the 48 Ss, all possible orders of the four experimental conditions were utilized twice, once with female Ss and once with male Ss. Since each S served as his own control in the four main conditions, with the stimulus presentations counterbalanced within each condition, and with the 24-hour rest period between sessions, it was felt that such factors as set, practice, and fatigue would not differentially influence the dependent variable.

For the 12 additional Ss, a change was made in the S_s. The coins were omitted. They were replaced by the coin-size, coin-metal discs that were used as the neutral stimuli in the main study. The coin-metal discs were replaced by two new S_s of identical sizes, but made from the same material and in the same way as the S_v. With the exception of this change in the S_s, the experimental treatment for these Ss was identical with that of the original 48 Ss.

CHAPTER III

RESULTS

The data for both experiments were analyzed as follows: the proportion of times each S_v was judged as larger than the S_s was determined. These proportions were obtained separately for each S in each experimental condition.[1] The proportions for all Ss within a given experimental treatment were then summed to obtain the summary psychophysical functions plotted in Figures 1, 2, 3, and 4.

In Figure 1 (Main Experiment, Small Size S_s), it can be seen that the Ss' judgments when the Neutral S_s was used tended to describe a steeper psychophysical function than was obtained with the Valued S_s. This, it will be recalled, is the opposite of what was predicted. A similar, but considerably reduced, tendency appears in the data in Figure 2 (Main Experiment, Large Size S_s).

In the Control Experiment, particularly when the small size S_s was used, a difference between the PSEs for the two types of discs can be seen (Figure 3). A

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[1] The proportion of times each S_v was judged larger than the S_s, in each of the experimental conditions, is presented for all Ss in the Appendix.

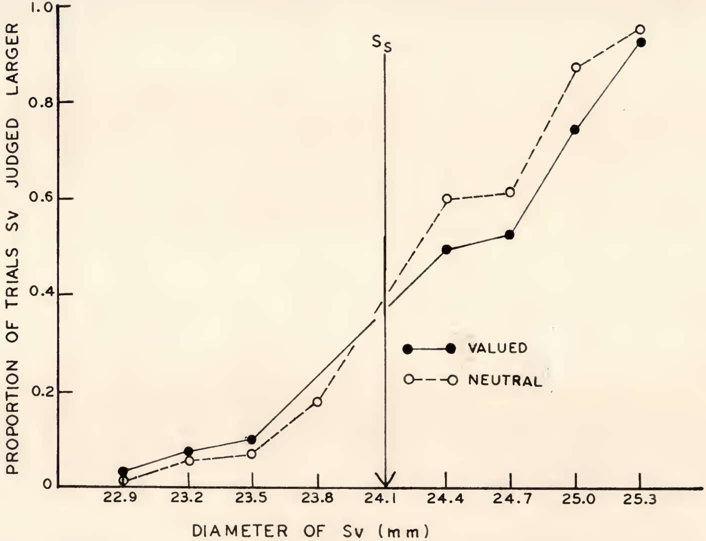

Figure 1--The mean proportion of trials in which each S_v was seen as larger than the S_s in the Small Size Conditions of the Main Experiment.

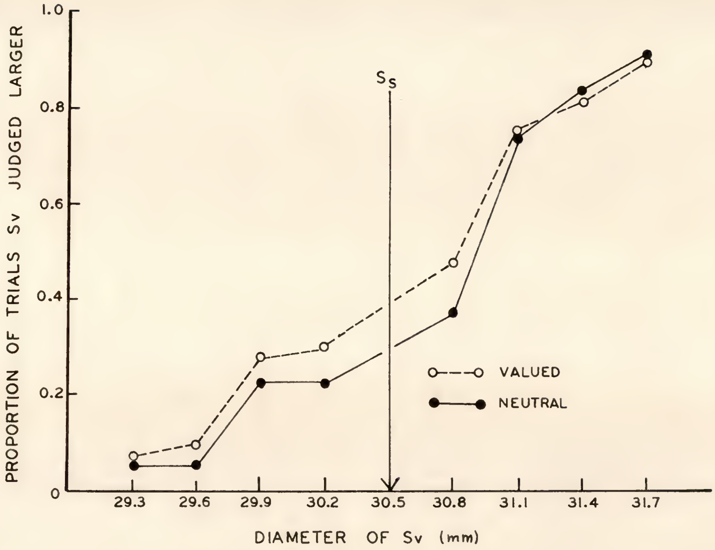

Figure 2--The mean proportion of trials in which each S_v was seen as larger than the S_s in the Large Size Conditions of the Main Experiment.

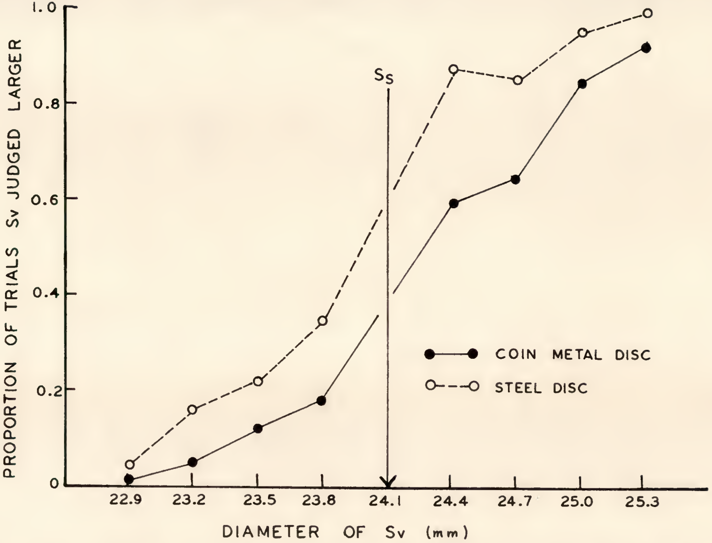

Figure 3--The mean proportion of trials in which each S_v was seen as larger than the S_s in the Small Size Conditions of the Control Experiment.

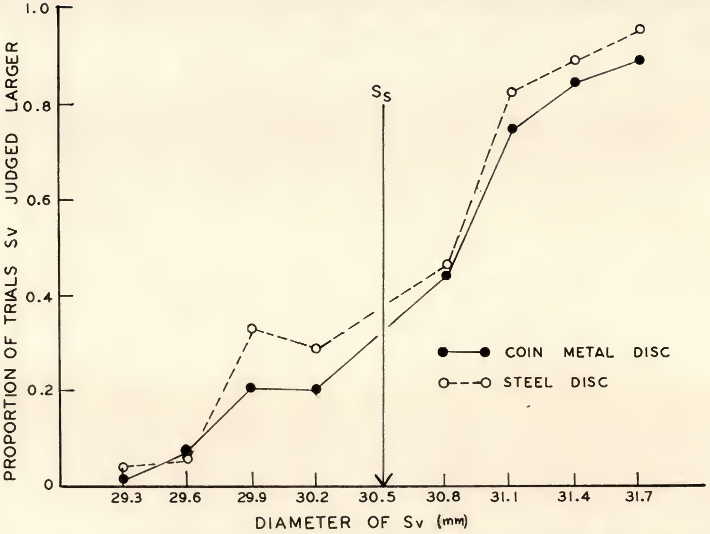

Figure 4--The mean proportion of trials in which the S_v was seen as larger than the S_s in the Large Size Conditions of the Control Experiment.

slight difference in the same direction was found also in the PSEs when the Large Size S_s was used (Figure 4).

A more analytical approach to these data was undertaken by fitting linear psychophysical functions to the z-transformations of the obtained proportions. This was done separately for each S in each condition using the method of least squares (Guilford, 1954). The average PSEs and DLs for the Main Experiment (and their standard deviations) obtained from these functions are presented in Tables 2 and 3.[2]

As can be seen in Table 2, the mean PSE in the Neutral S_s condition was slightly larger than in the Valued S_s Condition, when a large S_s (50-cent-size) was used, but this difference was reversed when a small S_s (25-cent-size) was used. Averaged across both S_s sizes, the difference vanished. When these data were subjected to an analysis of variance, summarized in Table 4, this interaction (between Value and Size) was significant at the .05 level. Also significant, of course, was the difference in PSE between the Large and Small S_s conditions, which testified to the fact that a different set of S_v was used in each case.

A comparison of the obtained average PSEs with the actual physical size of the S_s showed that the Ss systematically overestimated the size of the S_s in the Main

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[2] PSEs and DLs for individual Ss are given in the Appendix.

Table 2

Means and Standard Deviations of PSEs in the Main Experiment (N = 48)

Condition	S_s Size	$\overline{X}$	SD
Large-Valued	30.50 mm.		
Male		30.69	0.51
Female		30.60	0.43
Sexes Combined		30.64	--
Large-Neutral	30.50 mm.		
Male		30.77	0.35
Female		30.70	0.34
Sexes Combined		30.74	--
Small-Valued	24.10 mm.		
Male		24.50	0.47
Female		24.39	0.37
Sexes Combined		24.44	--
Small-Neutral	24.10 mm.		
Male		24.35	0.22
Female		24.32	0.28
Sexes Combined		24.34	--

Table 3

Means and Standard Deviations of DLs in the Main Experiment (N = 48)

Condition	$\overline{X}$	SD
Large-Valued		
Male	0.57	0.24
Female	0.68	0.27
Sexes Combined	0.63	--
Large-Neutral		
Male	0.53	0.23
Female	0.56	0.24
Sexes Combined	0.54	--
Small-Valued		
Male	0.44	0.11
Female	0.48	0.18
Sexes Combined	0.46	--
Small-Neutral		
Male	0.39	0.08
Female	0.46	0.18
Sexes Combined	0.43	--

Table 4

Analysis of Variance of PSEs in the Main Experiment

Source	df	MS	F
Subjects	(47)	0.35	--
Sex	1	0.35	--
Error (b)	46	0.35	--
Size	1	1900.27	31,671.17**
Size x Sex	1	0.00	--
Error_1 (w)	46	0.06	--
Value	1	0.00	--
Value x Sex	1	0.01	--
Error_2 (w)	46	0.14	--
Size x Value	1	0.35	5.00*
Size x Value x Sex	1	0.01	--
Error_3 (w)	46	0.07	--

* $p < .05$

** $p < .01$

Experiment. Two *t* tests (for the small size S_s and the large size S_s, separately) showed that this overestimation was statistically significant ($t_{small} = 7.98$, $df = 95$, $p < .01$; $t_{large} = 4.44$, $df = 95$, $p < .01$). None of the other effects, including the sex of the *S*s, was significant or even appreciable.

The prediction of smaller DLs in the Value condition in the Main Experiment was not supported. As can be seen in Table 3, the mean DLs were consistently larger in the Value condition. This unexpected effect for Value was significant at the .01 level. The analysis of variance of the DLs is summarized in Table 5. There was also a significant Size effect ($F = 31.67$, $p < .01$) on DLs in the Main Experiment, which verifies the Weber-Fechner Law. It can be seen in Table 3 that, regardless of Value, the mean DLs were substantially greater with the Large S_s than with the Small S_s.

None of the other effects were significant although there was a trend toward a Size x Value x Sex interaction, as is indicated in Table 5.

The average PSEs and DLs (and their standard deviations) for the Control Experiment are shown in Tables 6 and 7. As can be seen, in the PSEs in Table 6, there was, for men, increased overestimation in the Large condition for both the Coin-metal S_s and the Steel S_s. For women, there was greater overestimation of the Coin-metal S_s in the

Table 5

Analysis of Variance of DLs in the Main Experiment

Source	df	MS	F
Subjects	(47)	0.11	--
Sex	1	0.21	1.91
Error (b)	46	0.11	--
Size	1	0.95	31.67*
Size x Sex	1	0.00	--
Error_1 (w)	46	0.03	--
Value	1	0.18	9.00*
Value x Sex	1	0.00	--
Error_2 (w)	46	0.02	--
Size x Value	1	0.02	--
Size x Value x Sex	1	0.05	2.50
Error_3 (w)	46	0.02	--

* $p < .01$

Table 6

Means and Standard Deviations of PSEs in the Control Experiment (N = 12)

Condition	S_s Size	$\bar{X}$	SD
Large- Coin-Metal Disc	30.50 mm.		
Male		30.78	0.24
Female		30.74	0.32
Sexes Combined		30.76	--
Large- Steel Disc	30.50 mm.		
Male		30.60	0.12
Female		30.60	0.21
Sexes Combined		30.60	--
Small- Coin-Metal Disc	24.10 mm.		
Male		24.23	0.32
Female		24.43	0.39
Sexes Combined		24.33	--
Small- Steel Disc	24.19 mm.		
Male		24.05	0.10
Female		23.96	0.24
Sexes Combined		24.00	--

Table 7

Means and Standard Deviations of DLs in the Control Experiment (N = 12)

Condition	S_s Size	$\bar{X}$	SD
Large- Coin-Metal Disc	30.50 mm.		
Male		0.56	0.21
Female		0.48	0.14
Sexes Combined		0.52	--
Large- Steel Disc	30.50 mm.		
Male		0.51	0.16
Female		0.59	0.28
Sexes Combined		0.55	--
Small- Coin-Metal Disc	24.10 mm.		
Male		0.48	0.25
Female		0.42	0.12
Sexes Combined		0.45	--
Small- Steel Disc	24.10 mm.		
Male		0.45	0.22
Female		0.40	0.10
Sexes Combined		0.42	--

Small condition and of the Steel S_s in the Large condition. Both males and females underestimated the size of the S_s only in the Small condition with the Steel S_s. The analysis of variance of these data, summarized in Table 8, shows that this interaction of Size x Disc x Sex was significant at the .05 level. Again significant, of course, was the difference in PSEs between the Large and Small S_s conditions. It can be seen in Table 8 that there was a relative overestimation of the size of S_s in the Coin-metal conditions. The F of 4.38 (Table 8) for this effect indicates a definite trend but falls just short of the .05 level of significance.

A comparison of the obtained average PSEs with the actual physical size of the S_s in the Large condition in the Control Experiment showed a significant overestimate ($\underline{t}_{large} = 3.50$, df = 11, $p < .01$). This tendency appeared also with the Small S_s condition, but did not approach significance ($\underline{t}_{small} = 1.12$, df = 11, $p < .05$).

Only one trend in the average DLs, presented in Table 7, was apparent. The Large S_s conditions yielded larger DLs than were obtained with the Small S_s. The analysis of variance of the DLs, summarized in Table 9, showed this size effect to yield the largest F ratio. This difference, however, fell short of statistical significance.

Table 8

Analysis of Variance of PSEs in the Control Experiment

Source	df	MS	F
Subjects	(11)	0.08	--
Sex	1	0.00	--
Error (b)	10	0.08	--
Size	1	508.82	16,960.67**
Size x Sex	1	0.01	--
Error_1 (w)	10	0.03	--
Disc	1	0.70	4.38
Disc x Sex	1	0.00	--
Error_2 (w)	10	0.16	--
Size x Disc	1	0.02	--
Size x Disc x Sex	1	0.25	6.25*
Error_3 (w)	10	0.04	--

* $p < .05$

** $p < .01$

Table 9

Analysis of Variance of DLs in the Control Experiment

Source	df	MS	F
Subjects	(11)	0.09	--
Sex	1	0.01	--
Error (b)	10	0.10	--
Size	1	0.11	2.75
Size x Sex	1	0.01	--
Error_1 (w)	10	0.04	--
Disc	1	0.00	--
Disc x Sex	1	0.02	2.00
Error_2 (w)	10	0.01	--
Size x Disc	1	0.01	--
Size x Disc x Sex	1	0.02	--
Error_3 (w)	10	0.03	--

CHAPTER IV

DISCUSSION

The relationship between two objectively defined attributes of visual stimuli, size and value, and two measures of perceptual accuracy, the PSE and the DL, were investigated in this study. Male and female Ss were used in order to determine the possible differential effects of the stimulus variables on perceptual accuracy for each sex. The general predictions were that value of the stimulus would not affect PSEs, but would reduce DLs, and that no other effects would be apparent except for the Weber-Fechner relationship usually found in size perception.

Effects on the PSE

While no changes in PSE as a function of stimulus or sex variables were expected, several effects were evident.

The significant interaction effect in the Main Experiment between Size and Value, with greater overestimates in the Neutral condition for the Large S_s and greater overestimates in the Valued condition for the Small S_s, was quite surprising. It would not have been predicted from any of the theoretical positions discussed in Chapter I. This effect appeared to stem from the differential influence of value in the Small and Large S_s conditions, since it did not appear in the Control Experiment where value was not a variable. The findings are clear, the interpretation less so. It may be speculated that, because of the improved control of instructional, task, and physical stimulus variables in the present study, an effect of Value that was masked in previous studies became evident. On the basis of such a speculation, this interaction effect of Value will be discussed below when some general considerations in this type of research are explored.

The near-significant effect of the type of disc on the PSEs in the Control Experiment merits some discussion. This kind of PSE overestimate is what has frequently been found in the "New Look" studies since the 1947 work of Bruner and Goodman. A similar differential effect was obtained here, without a valued stimulus, solely on the basis of stimulus differences between the two non-valued S_s, such as hue and brightness. These differences in stimulus properties also obtained in all of the coin studies discussed in Chapter I. The PSE overestimates found in those studies, however, were generally attributed to the effect of the value dimension. The results of the present experiments indicate that such an interpretation of the earlier coin study findings is highly questionable and that a more parsimonious approach would emphasize brightness, hue, etc.

Another finding was that the obtained PSEs were consistent overestimates of the actual size of the physical stimulus. This, it will be remembered, was found for all treatments in both experiments with the single exception of the Small Steel-disc condition. This shift in PSEs, especially for the larger stimuli, has also been a usual finding in the literature cited in Chapter I. In general, it has been ignored or noted without explanation.

While the appearance of constant errors is ubiquitous with the use of various psychophysical methods, there is no ready-made explanation for this finding. It is interesting to note that overestimated PSEs for size are found even when the sense used is touch (Gaydos, 1958). Gaydos also was unsure of the source of this constant error in his research.

Effects on DLs

The most surprising and interesting finding in the study was the substantial increment in the size of DLs when the Ss were judging with the Valued S_s as compared with when they were judging with the Neutral S_s. Smaller DLs in the Value conditions had been predicted from multiplicative drive theory. Evidently, the effect of stimulus value on fine discriminations is such as to increase rather than decrease the variability of response, without producing a directional effect on perceived size. There was substantial evidence in the present study that this is not an artifact of the stimulus situation. The difference between the DLs that was obtained in the Main Experiment was absent in the Control Experiment, where the stimuli differed in hue and brightness but not in value. Further evidence that the DL effects in the Main Experiment were not artifactual lies in the obtained Size effect on the DLs. This finding, that DLs were greater the larger the S_s, is usual in psychophysical experiments where no other stimulus variables are present to override the effect. In the Control Experiment, the Weber-Fechner effect existed only as a pronounced trend, falling short of statistical significance. It is possible that this effect was attenuated or overridden by the hue and brightness differences between the S_s.

Sex Differences

It is clear that sex differences, uncontrolled or unreported in previous studies on value accentuation, yielded differences in the present results. The only thing that is clear about how these differences operated is that they were not simple or direct. In neither of the main effects of Sex in the two experiments was there a significant F ratio. There was a slight trend toward more variable behavior on the part of female *S*s. However, there was also a marked trend evident in the Size x Value x Sex interaction for the DLs in the Main Experiment. There was also a significant Size x Value x Sex interaction effect for PSEs in the Control Experiment. The sex of the Ss has, or seems to have, a complex effect on the way in which other factors influence the dependent measures, a trend which merits further study in its own right.

Conclusions

The following conclusions emerged from an evaluation of the present study and its results:

1. Because of the use of all Ss in all conditions and because of the care with which the stimulus and background properties were equated, it is unlikely that the findings can reasonably be attributed to any of the sources usually found to be suspect in previous coin studies.
2. The value of a stimulus does affect certain measures of one's perception of it. Apparently, the relationship is complex and involves the interaction of several variables.
3. Simple size overestimation appears to be more a function of method (task variables) or easily manipulable stimulus variables (e.g., brightness) than of value.
4. The effects of the various treatments seems to be partly a function of the sex of the Ss. Until this aspect of the results has been clarified by further study, generalizations across the sexes regarding the effect of value must be made cautiously.

CHAPTER V

SUMMARY

This study investigated the effect of stimulus value on two measures of perceptual accuracy, the PSE and the DL.

The two major hypotheses, generated in the context of multiplicative drive theory, were:

1. PSEs will remain the same for judgments of objects of the same size having different value.

2. DLs will be smaller in the conditions using a valued stimulus.

The standard stimuli used in the Main Experiment (N = 48) were a 50-cent piece, a 25-cent piece, a 50-cent-size, coin-metal disc, and a 25-cent-size, coin-metal disc. In the Control Experiment (N = 12), coin-metal and stainless steel discs were used.

Most of the 60 Ss were college students. The rest were of college age. In both the Main and Control Experiments, there were equal numbers of male and female Ss.

The psychophysical method of constant stimulus differences was utilized with eight comparison stimuli for each S_s. The data were analyzed by converting the proportions obtained to normal deviates (Z scores). A line was fitted to these points by the method of least squares. The average PSEs and DLs obtained from these functions were then subjected to analyses of variance.

The first hypothesis was not clearly supported. There was a significant Size x Value interaction effect in the PSEs. There was also significant overestimation of the S_s as manifested in the PSEs for all conditions save one in the Control Experiment.

The second hypothesis was not supported. The DLs in the Value conditions were significantly larger than were those in the Neutral condition.

The following conclusions emerged from an evaluation of the present study and its results:

1. Because of the use of all Ss in all conditions and because of the care with which the stimulus and background properties were equated, it is unlikely that the findings can reasonably be attributed to any of the sources usually found to be suspect in previous coin studies.

2. The value of a stimulus does affect certain measures of one's perception of it. Apparently, the relationship is complex and involves the interaction of several variables.

3. Simple size overestimation appears to be more a function of method (task variables) or easily manipulable

stimulus variables (e.g., brightness) than of value.

4. The effects of the various treatments seem to be partly a function of the sex of the Ss. Until this aspect of the results has been clarified by further study, generalizations across the sexes regarding the effect of value must be made cautiously.

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APPENDIX

Table 10

Main Experiment

Proportion of Trials S_v Judged Larger than S_s
Male Ss, Value Condition, 30.5 mm S_s

	Actual Size of S_v (mm)							
Ss	29.3	29.6	29.9	30.2	30.8	31.1	31.4	31.7
1	0	0	0	.05	.30	.50	.75	.85
2	.05	.05	.20	.05	.10	.45	.50	.60
3	.05	.05	.10	.20	.35	.75	.70	.85
4	.20	.45	.45	.65	.80	1.00	.95	1.00
5	0	0	.05	.10	.10	.45	.70	.90
6	0	0	.40	.30	.55	.80	.80	1.00
7	0	.10	.05	.05	.25	.45	.55	.70
8	.05	.20	.50	.70	.55	.90	.80	.80
9	0	0	.15	0	.20	.60	.85	.95
10	.05	.10	.40	.50	.65	.90	.85	1.00
11	.05	0	.15	.10	.70	.90	.90	.85
12	.15	0	.85	.70	.85	.90	1.00	1.00
13	0	.05	.30	.40	.65	.80	.95	1.00
14	0	.05	0	.05	.20	.45	.45	.70
15	0	0	.05	.15	.30	.60	.90	.95
16	.25	.10	.70	.50	.70	.95	.80	.90
17	0	0	0	.15	.05	.40	.55	.65
18	.05	.10	.45	.50	.85	.95	.95	1.00
19	0	0	.05	0	.20	1.00	1.00	1.00
20	.05	.05	.35	.75	.85	1.00	1.00	1.00
21	0	0	0	.05	.55	.55	.60	1.00
22	0	0	.05	0	.25	.75	.85	.95
23	0	0	.10	.10	.35	.85	.90	.95
24	.30	.25	.85	.95	.80	1.00	.95	1.00

Table 11

Main Experiment

Proportion of Trials S_v Judged Larger than S_s Male *S*s, Value Condition, 24.1 mm S_s

	Actual Size of S_v (mm)							
*S*s	22.9	23.2	23.5	23.8	24.4	24.7	25.0	25.3
1	0	.05	.05	.05	.30	.25	.75	.95
2	0	0	0	0	.35	.20	.80	1.00
3	0	0	.05	.30	.75	.80	.85	1.00
4	.15	.20	.30	.55	.90	.90	.95	1.00
5	0	0	0	0	.05	.05	.45	.65
6	0	0	0	.10	.35	.55	.80	1.00
7	0	0	0	0	.35	.15	.70	.90
8	.30	.60	.70	.70	.75	.95	.90	1.00
9	0	0	0	.05	.35	.50	.65	.95
10	0	0	0	.10	.60	.70	.80	.95
11	0	0	0	.05	.50	.70	.40	.95
12	0	.20	.30	.40	.80	.85	.95	1.00
13	0	0	0	.05	.25	.45	.90	1.00
14	0	.05	0	.05	.15	.20	.45	.85
15	0	.05	.05	.05	.45	.45	.45	1.00
16	0	.15	.20	.15	.35	.30	.80	.95
17	0	0	0	0	.15	.20	.40	.85
18	.05	0	.10	.10	.60	.30	.90	.95
19	0	0	0	.05	.20	.50	.75	1.00
20	0	0	.15	.15	.80	.85	1.00	1.00
21	0	0	0	.05	.30	.30	.65	.95
22	0	0	0	0	.10	.20	.75	.95
23	0	0	0	0	0	.15	.50	.85
24	.05	.25	.35	.55	.90	.95	1.00	1.00

Table 12

Main Experiment

Proportion of Trials S_v Judged Larger than S_s
Male Ss, Neutral Condition, 30.5 mm S_s

	Actual Size of S_v (mm)							
Ss	29.3	29.6	29.9	30.2	30.8	31.1	31.4	31.7
1	0	0	0	0	.20	.45	.75	.90
2	0	0	.05	0	0	.35	.45	.95
3	0	0	.40	.30	.60	.85	.90	.95
4	.10	.10	.10	.25	.35	.60	.85	.95
5	0	0	.10	.15	.25	.75	.65	.90
6	0	.15	.30	.40	.75	.80	.95	.95
7	.05	.05	.15	.20	.20	.65	.70	1.00
8	.40	.20	.60	.60	.80	.75	.95	.80
9	0	0	.25	.25	.35	.35	.90	.95
10	0	0	.15	.15	.20	.75	.70	1.00
11	0	0	.20	.15	.45	.85	.95	.95
12	0	0	.10	0	.25	.55	.85	.85
13	0	0	.30	.35	.35	.90	.90	1.00
14	.05	0	.20	.05	.30	.70	.75	.95
15	0	.05	.30	.25	.45	.90	.90	1.00
16	.05	.05	.30	.25	.25	.60	.60	.95
17	0	.05	.15	0	.15	.45	.55	.65
18	0	0	.30	.25	.50	.80	.85	.90
19	0	0	.05	.15	.50	1.00	.95	.95
20	0	0	0	.10	.30	.70	.95	.95
21	0	0	.25	.15	.40	.70	.95	.85
22	0	.10	.15	.25	.55	.90	1.00	1.00
23	0	.05	.25	.30	.35	.90	1.00	1.00
24	.10	.20	.50	.50	.40	1.00	.85	.90

Table 13

Main Experiment

Proportion of Trials S_v Judged Larger than S_s
Male Ss, Neutral Condition, 24.1 mm S_s

	Actual Size of S_v (mm)							
Ss	22.9	23.02	23.5	23.8	24.4	24.7	25.0	25.3
1	0	.05	0	.10	.60	.80	.95	1.00
2	0	0	.05	.15	.35	.40	.70	1.00
3	0	0	.15	.25	.75	.65	.95	1.00
4	0	.20	.15	.25	.55	.40	.85	.90
5	0	0	.05	.25	.60	.75	.90	1.00
6	0	0	.05	.20	.80	.90	1.00	1.00
7	0	0	0	0	.40	.50	.80	.90
8	0	.10	.15	.15	.15	.45	.65	.95
9	0	.05	0	.30	.65	.60	.95	1.00
10	.05	0	0	.05	.70	.45	.90	1.00
11	0	0	0	.10	.65	.75	.80	1.00
12	0	0	0	.05	.30	.45	.90	.95
13	0	.05	.15	.30	.75	.90	1.00	1.00
14	0	0	.10	.05	.65	1.00	.70	1.00
15	0	.05	.10	.10	.55	.55	.95	.95
16	.10	.10	.15	.55	.65	.85	.85	1.00
17	0	0	0	0	.35	.50	.75	.95
18	0	.05	.05	.25	.60	.60	.95	.95
19	0	0	0	.10	.75	.60	1.00	.95
20	0	0	0	.15	.40	.70	.90	1.00
21	0	0	.05	0	.10	.45	.85	.90
22	0	.05	0	.15	.65	.60	.95	1.00
23	0	0	.25	.30	.55	.70	.90	1.00
24	.05	.20	.20	.35	.70	.75	.95	1.00

Table 14

Main Experiment

Proportion of Trials S_v Judged Larger than S_s
Female *S*s, Value Condition, 30.5 mm S_s

	Actual Size of S_v (mm)							
*S*s	29.3	29.6	29.9	30.2	30.8	31.1	31.4	31.7
1	.40	.45	.70	.75	.50	.75	.75	1.00
2	0	0	0	0	0	.15	.45	.55
3	0	.05	.10	.10	.40	.85	.95	1.00
4	.15	.10	.40	.35	.55	.70	.75	.95
5	.30	.30	.85	.50	.80	1.00	1.00	1.00
6	0	0	.20	.10	.35	.80	.80	.95
7	.10	.05	.30	.55	.45	.80	.80	.80
8	0	.10	.35	.25	.70	.75	.85	.95
9	.05	.10	.30	.30	.45	.75	.85	.90
10	0	.15	.15	.20	.50	.40	.60	.80
11	.10	.15	.35	.70	.50	.90	1.00	.85
12	.10	.05	.35	.40	.75	.95	.95	1.00
13	0	.10	.25	.20	.35	.90	.75	.80
14	0	.05	.15	.35	.30	.85	.80	.80
15	0	0	.20	.30	.55	.95	.95	.95
16	0	.10	.10	.20	.45	.80	1.00	.95
17	.20	.25	.30	.10	.40	.70	.90	.80
18	.20	.05	.25	.45	.55	.80	.85	1.00
19	0	.05	.40	.50	.75	1.00	.95	1.00
20	.10	.35	.35	.35	.40	.65	.90	.90
21	.10	.05	.10	.25	.50	.55	.80	.85
22	.15	.15	.60	.45	.40	.85	.85	.80
23	.10	.05	.20	.20	.40	.45	.55	.80
24	0	0	.10	.05	.20	.95	1.00	1.00

Table 15

Main Experiment

Proportion of Trials S_v Judged Larger than S_s Female Ss, Value Condition, 24.1 mm S_s

	Actual Size of S_v (mm)							
Ss	22.9	23.2	23.5	23.8	24.4	24.7	25.0	25.3
1	.25	.50	.40	.70	.85	.80	.95	.95
2	0	0	0	0	.05	.10	.10	1.00
3	0	0	.15	.45	.90	.90	1.00	1.00
4	0	.25	.05	.30	.95	.40	.90	.95
5	.05	.10	.15	.30	1.00	.90	.95	1.00
6	0	0	0	0	.35	.35	.75	.95
7	0	.15	.20	.40	.85	.80	.85	1.00
8	0	.05	.10	.10	.70	.65	.80	1.00
9	0	.05	.10	.20	.55	.55	.75	.95
10	0	0	0	.10	.50	.40	.50	.85
11	0	0	0	.25	.45	.40	.95	.95
12	0	.10	.25	.15	.75	.85	.95	1.00
13	0	0	0	.05	.40	.30	.75	.85
14	0	0	0	.05	.25	.20	.60	.95
15	0	0	0	.05	.40	.80	.80	.95
16	0	.05	.15	.10	.55	.85	.90	1.00
17	0	.10	.35	.40	.60	.70	.70	.85
18	.05	.35	.30	.45	.90	.80	.80	.95
19	0	0	.05	.15	.65	.65	.65	1.00
20	.05	.10	.10	.15	.30	.65	.80	.95
21	0	0	.10	.10	.25	.50	.40	.90
22	0	0	0	.25	.85	.35	.60	.75
23	0	0	.05	.05	.30	.40	.50	.65
24	0	0	0	0	.35	.40	.85	1.00

Table 16

Main Experiment

Proportion of Trials S_v Judged Larger than S_s Female *S*s, Neutral Condition, 30.5 mm S_s

	Actual Size of S_v (mm)							
*S*s	29.3	29.6	29.9	30.2	30.8	31.1	31.4	31.7
1	.35	0	.25	.50	.60	.75	.85	.85
2	0	0	.05	.05	.30	.40	.80	.95
3	0	.10	.40	.10	.35	.80	1.00	.95
4	0	0	.25	.05	.35	.65	.75	.70
5	0	.05	.60	.30	.35	1.00	1.00	1.00
6	0	0	.15	0	.30	.75	.95	.90
7	0	.05	.15	.20	.50	.75	.95	.95
8	0	0	.05	.20	.40	1.00	.95	.85
9	.05	.05	.25	.25	.40	.75	.80	1.00
10	.40	.40	.40	.45	.55	.50	.75	.80
11	0	0	.05	.10	.05	.40	.30	.75
12	.10	.05	0	.20	.45	.75	.75	.95
13	.10	0	.20	.35	.30	.85	.70	.90
14	0	0	.10	.35	.50	.75	.95	.95
15	0	0	.35	.20	.40	.95	.95	1.00
16	.05	.05	.20	.35	.35	1.00	1.00	.95
17	.10	.05	.40	.25	.25	.65	.55	.70
18	0	0	.35	.10	.45	.70	.75	.95
19	.05	.05	.25	.15	.55	.95	.90	1.00
20	.05	.40	.55	.55	.60	.70	.80	.85
21	0	.10	.10	.10	.10	.85	.70	.70
22	.35	.15	.45	.45	.75	.95	.95	1.00
23	0	0	0	.10	.40	.55	.75	.90
24	0	0	.15	.40	.30	1.00	1.00	1.00

Table 17

Main Experiment

Proportion of Trials S_v Judged Larger than S_s
Female Ss, Neutral Condition, 24.1 mm S_s

	Actual Size of S_v (mm)							
Ss	22.9	23.2	23.5	23.8	24.4	24.7	25.0	25.3
1	.05	.25	.20	.50	.70	.70	.90	.95
2	.05	0	0	.05	.30	.35	.85	.85
3	0	.05	.05	.20	.70	.70	1.00	1.00
4	0	.20	.25	.25	.45	.35	.80	.95
5	.05	.05	0	.20	.75	.55	1.00	.95
6	0	0	0	.05	.55	.35	1.00	1.00
7	0	0	.05	.30	.70	.60	.85	.95
8	0	.10	.05	.25	.70	.80	1.00	1.00
9	0	.10	.05	.20	.65	.60	.90	.95
10	0	0	0	.25	.50	.65	.75	.95
11	0	.10	.05	.15	.55	.55	1.00	.95
12	0	.10	.05	.25	.75	.75	1.00	.95
13	0	.20	0	.05	.65	.40	.75	.80
14	0	0	0	.05	.85	.60	1.00	1.00
15	0	.10	0	.05	.70	.90	1.00	1.00
16	0	.10	0	.10	.70	.70	1.00	.90
17	0	.05	.05	.05	.35	.40	.40	.75
18	0	.20	.05	.20	.65	.55	.75	1.00
19	0	.15	.05	.50	.70	.90	1.00	1.00
20	.15	.20	.15	.25	.65	.65	.80	.85
21	0	0	.30	.15	.70	.70	.90	1.00
22	0	.10	.15	.45	.80	.55	.90	1.00
23	.10	.15	.10	.40	.45	.70	.75	.75
24	0	0	0	.10	.95	.85	1.00	1.00

Table 18

Control Experiment

Proportion of Trials S_v Judged Larger than S_s
Male and Female *S*s, Value Condition, 30.5 mm S_s

	Actual Size of S_v (mm)							
*S*s	29.3	29.6	29.9	30.2	30.8	31.1	31.4	31.7
Male								
1	.05	.10	.20	.05	.30	.60	.75	.80
2	0	.05	.15	.05	.50	.90	.95	.95
3	0	.20	.25	.20	.25	.65	.65	.75
4	0	0	.30	.10	.45	.95	1.00	.95
5	.05	0	0	.05	.35	.65	.90	.95
6	0	.25	.25	.45	.95	.85	1.00	.95
Female								
1	0	0	.10	.10	.05	.55	.60	.80
2	0	0	.15	.20	.55	.75	.95	1.00
3	0	.25	.55	.65	.85	.90	1.00	.95
4	0	0	.20	.15	.35	1.00	1.00	1.00
5	0	.05	.20	.35	.55	.60	.60	.85
6	.05	0	.30	.15	.30	.70	.75	.85

Table 19

Control Experiment

Proportion of Trials S_v Judged Larger than S_s
Male and Female Ss, Value Condition, 24.1 mm S_s

	Actual Size of S_v (mm)							
Ss	22.9	23.2	23.5	23.8	24.4	24.7	25.0	25.3
Male								
1	0	.10	.10	.45	.80	.85	1.00	1.00
2	0	.05	0	.15	.80	.75	.95	1.00
3	.05	.05	.05	.20	.40	.20	.50	.85
4	0	.05	.05	.25	.75	.80	1.00	1.00
5	0	0	0	.05	.40	.55	.95	1.00
6	.05	.15	.50	.25	.60	.90	.85	1.00
Female								
1	0	0	.05	.05	.20	.40	.60	.65
2	0	0	0	0	.65	.65	.90	1.00
3	0	.10	.25	.30	.85	.90	1.00	1.00
4	0	0	0	.10	.60	.70	1.00	1.00
5	0	.05	.35	.25	.70	.70	.90	.95
6	0	0	.05	.05	.50	.35	.50	.75

Table 20

Control Experiment

Proportion of Trials S_v Judged Larger than S_s
Male and Female *S*s, Neutral Condition, 30.5 mm S_s

	Actual Size of S_v (mm)							
*S*s	29.3	29.6	29.9	30.2	30.8	31.1	31.4	31.7
Male								
1	0	.10	.40	.20	.35	.65	.95	.90
2	0	.05	.20	.20	.40	.80	.95	.95
3	.10	0	.20	.30	.45	.80	.70	1.00
4	0	0	.55	.25	.65	.90	.95	.95
5	0	0	.20	.10	.45	1.00	1.00	1.00
6	.05	.15	.40	.35	.50	.90	.80	.95
Female								
1	.20	.25	.45	.40	.60	.75	.80	.95
2	0	0	.25	.20	.30	.85	1.00	.95
3	0	0	.15	0	.35	.85	.95	.95
4	0	0	.35	.35	.50	.90	1.00	1.00
5	.10	.15	.50	.40	.45	.80	.85	1.00
6	.05	.05	.35	.40	.50	.75	.85	.95

Table 21

Control Experiment

Proportion of Trials S_v Judged Larger than S_s
Male and Female Ss, Neutral Condition, 24.1 mm S_s

	Actual Size of S_v (mm)							
Ss	22.9	23.2	23.5	23.8	24.4	24.7	25.0	25.3
Male								
1	0	.05	0	.50	.90	.75	.90	.75
2	0	.15	.05	.25	.95	1.00	1.00	1.00
3	.05	.25	.35	.45	.85	.80	.75	.90
4	0	.10	.10	.25	.85	.85	1.00	1.00
5	0	.10	.20	.30	.90	.90	1.00	1.00
6	0	.30	.45	.10	.90	.90	1.00	1.00
Female								
1	.10	.15	.50	.50	.90	1.00	1.00	1.00
2	0	0	.20	.35	.95	.80	1.00	1.00
3	0	.15	0	.30	.85	.90	1.00	1.00
4	0	.10	.15	.35	.90	.85	.95	.95
5	0	.35	.45	.30	.70	.70	.90	1.00
6	.10	.30	.30	.55	.85	.85	.95	1.00

Table 22

PSEs in all Four Conditions for Male Ss in the Main Experiment (N = 24)

Ss	Value		Neutral	
	Large	Small	Large	Small
1	31.1469[a]	24.6391	31.2338	24.2776
2	31.5919	24.5939	31.5131	24.4126
3	30.8764	24.2524	30.7451	24.2273
4	29.8417	23.6877	30.7017	24.4356
5	31.1279	25.1542	31.0045	24.2732
6	30.6348	24.4516	30.5365	24.1128
7	31.1953	24.8952	30.6539	24.7704
8	30.3516	23.3013	29.9218	24.4699
9	31.0669	24.6999	30.8078	24.2702
10	30.2588	24.5731	30.7623	24.3613
11	30.7613	24.6929	30.7894	24.3885
12	30.1590	24.0014	31.1372	24.6409
13	30.4771	24.4645	30.6196	23.9872
14	31.3569	24.9722	30.9218	24.1779
15	30.9228	24.3225	30.5201	24.3859
16	30.1211	24.5080	30.8320	24.2058
17	30.1700	24.4898	30.8418	24.3526
18	30.3802	25.0451	31.4220	24.7570
19	30.6951	24.5028	30.7176	24.3650
20	30.0360	24.1073	30.9560	24.3921
21	30.8750	24.7495	30.8774	24.7820
22	31.0399	24.8796	30.3980	24.2912
23	30.8578	25.2815	30.4127	24.2440
24	29.6674	23.6507	30.1245	23.8936

[a] All PSEs reported in mm.

Table 23

PSEs in all Four Conditions for Female Ss in the Main Experiment (N = 24)

Ss	Value		Neutral	
	Large	Small	Large	Small
1	29.7725[a]	23.4464	30.3909	24.0179
2	31.8906	24.7075	31.0252	24.7651
3	30.5839	24.0495	30.5391	24.0624
4	30.5000	24.2695	31.0785	24.4805
5	29.7477	23.7087	30.2735	24.1951
6	30.8910	24.7864	30.9986	24.3044
7	30.6127	24.0585	30.7187	24.4547
8	30.6688	24.2238	30.6860	24.0265
9	30.6014	24.3860	30.7027	24.3000
10	31.1619	24.7770	30.3974	24.5869
11	30.2545	24.5620	31.4038	24.2077
12	30.2255	24.0823	30.8850	24.1310
13	30.8338	24.7718	30.8625	24.6362
14	30.8551	24.8002	30.7935	24.2457
15	30.7144	24.5934	30.5922	24.1417
16	30.5546	24.1734	30.2323	24.2995
17	30.6321	24.3893	31.0660	24.8653
18	30.3002	23.8937	30.8962	24.2162
19	30.3051	24.3448	30.3756	23.9689
20	30.4669	24.3439	30.3459	24.2210
21	30.8184	24.7458	31.0633	24.2414
22	30.3951	24.7185	30.0297	24.1105
23	31.0710	24.8844	31.0840	25.1000
24	30.5763	24.5481	30.4253	24.1846

[a] All PSEs reported in mm.

Table 24

DLs in all Four Conditions for Male *S*s in the Main Experiment (N = 24)

	Value		Neutral	
*S*s	Large	Small	Large	Small
1	.4167	.5537	.3919	.3399
2	1.2623	.3197	.4918	.3682
3	.8459	.3386	.4318	.3396
4	.5402	.5571	.8189	.6185
5	.4783	.4743	.4677	.3379
6	.3656	.3241	.5131	.2840
7	.6301	.4081	.4204	.3806
8	1.0507	.7653	1.3605	.5848
9	.4153	.4010	.4283	.3519
10	.5466	.3785	.3668	.3734
11	.5459	.4054	.4083	.3136
12	.3995	.4131	.4353	.3816
13	.3989	.3190	.3507	.3294
14	.5790	.5705	.5818	.3102
15	.4222	.4101	.4016	.4919
16	1.0638	.6112	.8854	.4148
17	.4897	.4435	.6522	.3744
18	.5020	.5628	.4550	.4857
19	.6293	.3292	.5137	.3164
20	.3708	.2908	.3659	.3128
21	.3294	.4117	.4480	.4296
22	.3952	.3955	.3385	.3484
23	.4107	.4738	.3406	.3546
24	.5869	.4316	.7624	.5311

Table 25

DLs in all Four Conditions for Female Ss in the Main Experiment (N = 24)

Ss	Value		Neutral	
	Large	Small	Large	Small
1	.9479	1.0804	.7582	.8104
2	.5300	.3382	.4400	.5274
3	.3795	.2907	.4348	.3303
4	.9662	.5404	.5086	.6281
5	.4699	.4510	.3190	.4527
6	.4363	.3805	.4013	.2776
7	.9793	.4205	.4915	.4242
8	.5489	.4045	.3684	.3341
9	.6852	.4434	.5583	.4628
10	.6999	.4432	.6842	.3919
11	.6376	.3795	.5720	.4182
12	.5014	.3929	.6285	.4064
13	.6098	.4242	.6503	.5125
14	.5846	.4234	.4119	.2686
15	.3998	.3745	.3367	.2979
16	.4159	.3892	.4537	.3773
17	1.1480	.6465	1.3053	.6706
18	.5875	.8596	.4560	.4367
19	.3536	.3561	.4856	.3373
20	1.0620	.7712	1.2089	1.0417
21	.8906	.5074	.6410	.3504
22	1.1826	.4470	.6020	.4195
23	1.1392	.5391	.4091	.6694
24	.2880	.3099	.2742	.2615

Table 26

PSEs in all Four Conditions for Male and Female Ss in the Control Experiment (N = 12)

Ss	Coin-Metal Disc		Steel Disc	
	Large	Small	Large	Small
Male				
1	30.9908[a]	23.9658	30.7451	24.3954
2	30.7184	24.2495	30.7132	23.8701
3	31.0081	24.8331	30.5827	24.2164
4	30.6144	24.0367	30.6878	23.9818
5	30.9819	24.4119	30.4413	23.9364
6	30.3462	23.8760	30.4555	23.8955
Female				
1	31.2148	24.8790	30.7054	23.5587
2	30.6450	24.4663	30.6497	24.0541
3	30.2827	23.9376	30.9331	24.0711
4	30.4415	24.2524	30.4811	24.1667
5	30.9098	24.2791	30.2551	24.2042
6	30.9516	24.7856	30.5545	23.7068

[a] All PSEs reported in mm.

Table 27

DLs in all Four Conditions for Male and Female Ss in the Control Experiment (N = 12)

	Coin-Metal Disc		Steel Disc	
Ss	Large	Small	Large	Small
Male				
1	.9439	.3375	.5702	.4320
2	.4658	.3399	.4957	.2971
3	.7311	1.0095	.4692	.9312
4	.3466	.3266	.4208	.3328
5	.4622	.3080	.2700	.3348
6	.4318	.5583	.8104	.3541
Female				
1	.5217	.5322	1.0877	.3962
2	.3383	.2957	.3586	.2939
3	.4563	.3384	.3816	.3045
4	.2720	.2710	.3021	.4850
5	.6318	.5249	.6181	.3595
6	.6593	.5346	.7650	.5698

BIOGRAPHICAL SKETCH

Murray J. Landsman was born September 28, 1929 in Syracuse, New York. He attended high school in several cities and was graduated by GED test in June, 1954. From September, 1949 to June, 1954, Mr. Landsman attended Bradley University in Peoria, Illinois. He received the Bachelor of Science degree in June, 1954. He attended Northwestern University on a part-time basis in 1955 and 1956 as well as continuing his graduate work at Bradley. He received the degree of Master of Arts from Bradley University in June, 1955.

In 1956, Mr. Landsman enrolled in the Graduate School of the University of Florida. He did his clinical psychology internship in the Clinical Psychology Department, University of Florida College of Medicine and in the Mental Health Division of the Alachua County Health Department in Gainesville, Florida. He completed the internship in June, 1960 and continued on the staff at the Health Department until assuming the position of Assistant Professor of Psychology, Rollins College, Winter Park, Florida from September, 1960 to June, 1962. Mr. Landsman was an Interim Instructor in the Clinical Psychology Department, University of Florida College of

Medicine during the summer of 1962. In the fall of 1962 he took a position as Interim Clinic Associate in the University Counseling Center, University of Florida. In July, 1963 he was appointed Assistant Counseling Psychologist on the Counseling Center Staff.

Murray J. Landsman is a member of the American Psychological Association and the Florida Psychological Association.

This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Arts and Sciences and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December 19, 1964

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